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COLLEGE OF ENGINEERING
DEPARTMENT OF AERONAUTICAL AND ASTRONAUTICAL ENGINEERING
HIGH ALTITUDE ENGINEERING LABORATORY

Scientific Report

Additional Rocket-Borne Mass Spectrometer Measurements of the Dissociation of Oxygen

UNPUBLISHED PRELIMINARY DATA

E. J. SCHAEFER
J. BROWN

Under contract with:

National Aeronautics and Space Administration
Contract No. NASr-54(05)
Washington, D. C.

Administered through: *January 1964*

OFFICE OF RESEARCH ADMINISTRATION • ANN ARBOR

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An earlier letter (Schaefer, 1963) described an experiment to measure the ambient neutral composition of the upper atmosphere by a rocket-borne "massenfilter" (Schaefer and Nichols, 1961). Preliminary curves of the ratio of the O_1 current to the O_2 current were presented.

The experiment was repeated using a similar instrument with the same open ion source aboard a Nike-Apache rocket launched at 0255 EST 28 March 1963 at Wallops Island, Virginia.

The following changes were made in the second experiment:

1. The use of a Nike-Apache rocket permitted measurements to 190 km instead of to 134.5 km.

2. The sensitivity of the massenfilter was increased by a factor of three, requiring a reduction in scan rate from 2 per second to 1 per second.

3. Improvements in the airborne circuitry yielded a reduction in noise level to 1/4 of that of the previous flight.

4. The instrumentation was ejected from a canister evacuated to a few microns pressure instead of from a canister back-filled with helium.

The major spectral peaks at atomic mass numbers 14, 16, 18, 28, 32, 40 and 44 were identified as N_1, O_1, H_2O, N_2, O_2, A and CO_2 (and N_2O). Several minor spectral peaks were found on the records. The identification of these components and the analysis of the data is in progress.

The precession of the second payload was less than the first, as indicated by smoother curves of the component currents, both ascending and descending. There are still marked differences between the absolute component

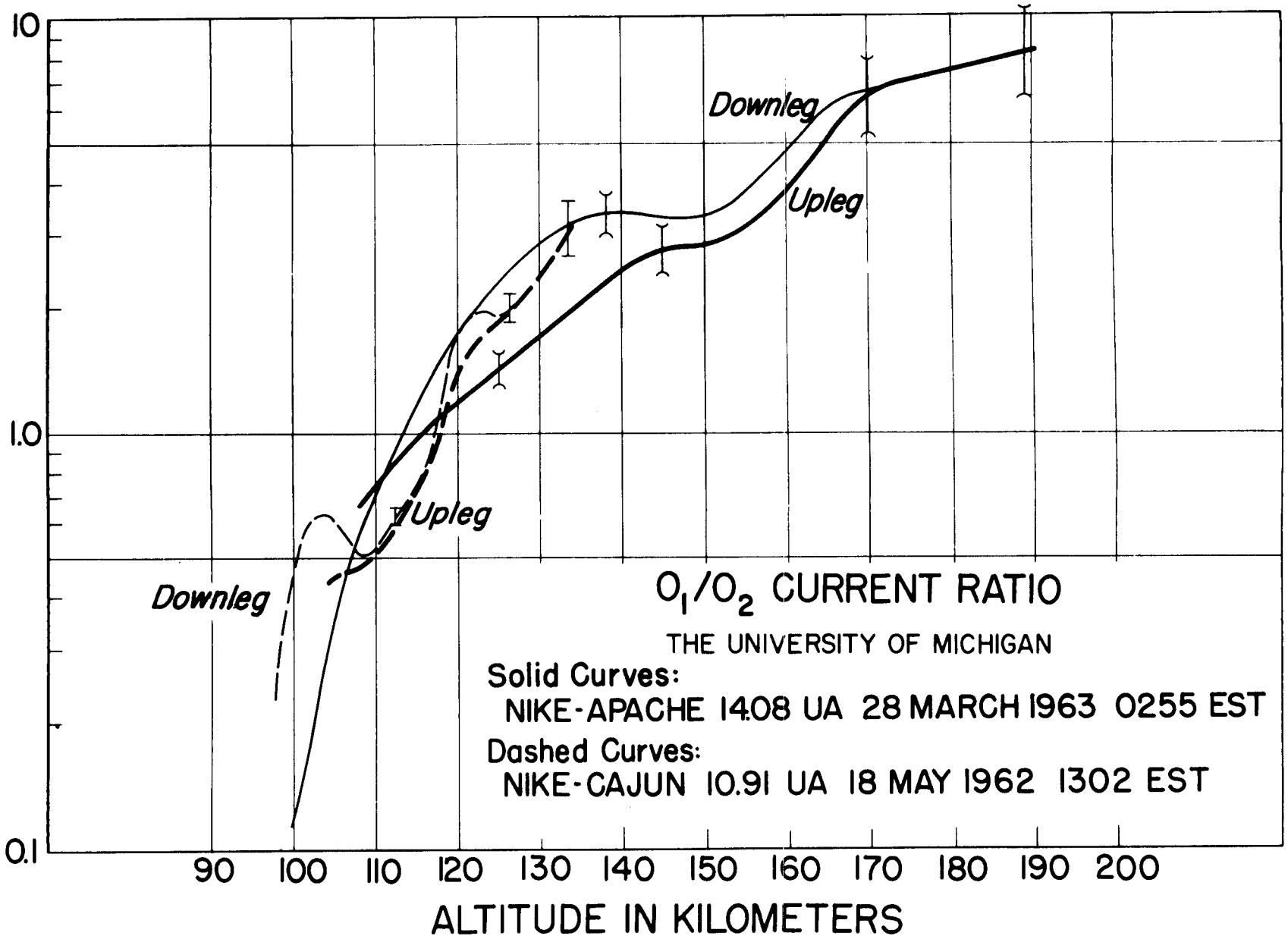
currents on the upleg and downleg due to the difference in angle of attack. The curves for the different components are similar in shape, so that when current ratios are taken, the upleg and downleg differences are considerably reduced.

The ratio of interest in this preliminary report, the O_1/O_2 current ratio is shown in Figure 1 along with the curves from the earlier report. There is generally good agreement in spite of the differences in season and in the time of day between the measurements. The error bars show only the probable error indicated by the scatter of the data points and do not include the errors resulting from differences in angle of attack.

References

1. Schaefer, Edward J., The dissociation of oxygen measured by a rocket-borne mass spectrometer, Jour. Geophys. Rev. 68, 1175, 1963.

2. Schaefer, E. J. and M. H. Nichols, Mass spectrometer for upper air measurements, Am. Rocket Soc. Jour., 31, 1773-1776, 1961.


10
1.0
0.1
Downleg
Upleg
Upleg
Downleg
O_1/O_2 CURRENT RATIO
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Solid Curves:
NIKE-APACHE 14.08 UA 28 MARCH 1963 0255 EST
Dashed Curves:
NIKE-CAJUN 10.91 UA 18 MAY 1962 1302 EST
90 100 110 120 130 140 150 160 170 180 190 200
ALTITUDE IN KILOMETERS

Figure 1